

# Expectations, disappointments, and individual responses: Imbalances in multilevel flood risk governance revealed by public survey

Pavel Raška<sup>1</sup>  | Weronika Warachowska<sup>2</sup> | Lenka Slavíková<sup>3</sup> | Tereza Aubrechtová<sup>4</sup>

<sup>1</sup>Department of Geography, Faculty of Science, J. E. Purkyně University in Ústí and Labem, Ústí nad Labem, Czechia

<sup>2</sup>Institute of Geoecology and Geoinformation, Adam Mickiewicz University, Poznań, Poland

<sup>3</sup>Institute for Economic and Environmental Policy, Faculty of Social and Economic Studies, J. E. Purkyně University in Ústí and Labem, Ústí nad Labem, Czechia

<sup>4</sup>Department of Physical Geography and Geoecology, Faculty of Science, University of Ostrava, Ostrava, Czechia

## Correspondence

Pavel Raška, Department of Geography, Faculty of Science, J. E. Purkyně University in Ústí and Labem Address: České mládeže 8, 400 96 Ústí nad Labem, Czechia  
Email: pavel.raska@ujep.cz

## Funding information

LAND4FLOOD, Grant/Award Number: CA16209; Smart City - Smart Region - Smart Community, Grant/Award Number: CZ.02.1.01/0.0/0.0/17\_048/0007435; European Cooperation in Science and Technology

## Abstract

The recent paradigm shift towards multilevel flood risk governance has raised discussions about the potential of different entities to undertake specific flood risk management (FRM) measures and about the effects of their efforts on other governance levels. Among the key questions being addressed are those related to the balance and possible inverse proportions between governmental efforts and motivation for individual action. In this paper, we use the results of a flood perception survey among individuals in two flood-prone Czech municipalities to reveal the discrepancies between the expectations of responsibility-sharing and the actual willingness for individual flood risk reduction. While the results indicate strong expectations of the responsibilities of the governmental bodies for initiating FRM, the respondents also expressed low confidence in completed FRM measures and strong self-reliance during floods and recovery. Our results partly contradict the crowding-out thesis, which denotes the negative effects of governmental actions on willingness to undertake individual mitigation measures. Furthermore, the results indicate that differences in the confidence in government-driven FRM measures between the two study areas are caused by the differential perception of scales of FRM measures and catchment complexity, thus diverging expectations of responsibility-sharing within a country-scale FRM institutional setting.

## KEYWORDS

risk governance, risk management, risk perception

## 1 | INTRODUCTION

Issues of responsibility sharing and a discussion of the legitimacy of flood risk management (FRM) options have been increasingly addressed in the recent discourse

(Council of European Communities, 2007; Penning-Rowsell, Priest, & Johnson, 2014; Pettersson et al., 2017). Along with the shift from flood defence to more complex FRM (Schanze, 2013; Thomalla et al., 2018), the need for the involvement of actors in FRM at different governance

This is an open access article under the terms of the Creative Commons Attribution-NonCommercial-NoDerivs License, which permits use and distribution in any medium, provided the original work is properly cited, the use is non-commercial and no modifications or adaptations are made.

© 2020 The Authors. *Journal of Flood Risk Management* published by Chartered Institution of Water and Environmental Management and John Wiley & Sons Ltd.

levels is considered necessary (Mees et al., 2016; Thaler & Priest, 2014). In this paper, we build upon the multilevel governance schemes, which are based on the notion that national FRM takes place within international policy domains and, at the same time, their efficiency and legitimacy may increase with the introduction of decentralised governance including non-state actors (Rollason, Bracken, Hardy, & Large, 2018; Termeer, Dewulf, & van Lieshout, 2010). They are also assumed to better fit the dynamics of social-ecological interactions within FRM and to facilitate responsibility-sharing for FRM decisions and recovery payments. This may finally result in diversification and reduction of flood losses (Henstra, Thistlethwaite, Brown, & Scott, 2019). On the other hand, multilevel governance places significant demands on effective cross-level interactions and collaboration among actors (Van Herk, 2014). While the complexity of FRM necessitates overlap among governmental and public actors (Marks & Hooghe, 2004), coordination dilemmas and perceived ineffectiveness are considered major problems within the increasingly fragmented FRM (Consoer & Milman, 2018; Gilissen et al., 2016). These problems challenge both the mechanisms of cross-level interactions (Termeer et al., 2010) and the expectations of individual actors in current FRM (Wehn, Rusca, Evers, & Lanfranchi, 2015). In this paper, we attempt to link the current research on the effects of multilevel flood risk governance strategies and individual FRM perceptions to reveal the differences between the expected and existing responsibility-sharing within the multilevel FRM.

## 1.1 | Public perception and responsibility sharing in FRM

Along with institutional approaches (e.g., Priest, 2016), it has been argued that flood risk perception studies provide important insights to improve convergence between FRM strategies and their support from individuals (Vávra, Lapka, Cudlínová, & Dvořáková-Líšková, 2017). Several studies surveyed flood risk perception at the household and/or individual levels. Among these, many authors focused primarily on approaches to flood insurance—for example, the effect of perceived flood risk on the willingness to buy insurance was confirmed (Botzen, Aerts, & van den Bergh, 2009; Seifert, Botzen, Kreibich, & Aerts, 2013 for Germany and the Netherlands; Shao et al., 2017 for the United States). Contrarily, based on a survey in Australia, Lo (2013) concluded that higher risk perception is not correlated with higher insurance demand and that perceived social norms are more significant factors.

Other authors focused on wider range of individual flood mitigation measures and they into some extent addressed the responsibility-sharing among public and private actors and the so-called crowding-out effect of governmental actions on the willingness for individual efforts (see Slavíková, 2018 for discussion in FRM context). However, these studies did not come to strong conclusions in this respect. Osberghaus (2015) surveyed 4,200 households in Germany and concluded that both past flood damage experience and future damage expectations increase household efforts to implement mitigation measures. He did not confirm the negative effect of government activity on individual mitigation measures: “In the case of expecting government relief payments, we find that the correlation with mitigation depends on individual characteristics, with some households increasing, other decreasing their mitigation efforts” (Osberghaus (2015), p. 43). Similarly, Richert, Erdlenbruch, and Figuières (2017) confirmed the linkage among individual flood risk mitigation and flood experience in France, but they call for further investigation to prove the relationship between reliance on public flood protection and private mitigation. Kienzler, Pech, Kreibich, Müller, and Thieken (2015) revealed that private precaution is higher after a flood, but they also concluded that flood experience and knowledge did not necessarily result in private investment in flood-proofing measures. They admitted that they did not investigate the influence of government compensation payments and other factors. State programs encouraging proactive behaviour are required in this matter (see also Kreibich et al., 2011).

As a result, we may state that only a couple of studies based on risk perception surveys have explicitly addressed the balance of roles among different actors within multilevel governance in FRM. In this respect, some authors have found that local governments are still perceived as the most responsible actors in FRM (Terpstra & Gutteling, 2008) and that “people who attribute responsibility for damage mitigation to government have a less positive attitude toward their own damage mitigation activities” (pp. 563–564). This finding agrees with Newig, Challies, Jager, and Kochskämper (2014), who assign the highest importance in FRM to local and national governments and the public. Lawrence, Quade, and Becker (2014) acquired similar evidence in New Zealand, and they also concluded that households affected by floods have a stronger preference for sharing responsibility with the central government. Some authors argue that reliance upon the national government results from a persisting preference for structural FRM measures and the limited financial and legal capacities of the local public and local governments to perform such measures (Figueiredo, Valente, Coelho, & Pinho, 2009; Slavíková,

Raška, & Kopáček, 2019; Tunstall, Penning-Rowsell, Tapsell, & Eden, 2000).

To conclude, none of the studies converge towards universal determinants of expectations about the ideal balance in responsibility-sharing. This is because (a) such expectations of individuals will be influenced by complex links among risk perception and coping appraisal, denoting person's potential to cope with adverse situations based on response efficacy, response costs, and self-efficacy (Babcicky & Seebauer, 2017; Bandura, 1997; Bubeck, Botzen, & Aerts, 2012), and (b) governmental actions always take place in specific socio-economic settings and political and legal traditions (Klůvanková-Oravská, ed., 2010; Priest et al., 2016). The present paper aims at supporting the afore-reviewed fragmented evidence by bringing the post-socialist context perspective on multilevel governance and responsibility-sharing.

Addressing the feasibility of goals of the EU Floods Directive, Raška (2015) focused on flood risk perception in post-socialist Central and Eastern European Countries (CEECs) and reviewed surveys conducted between 1990 and 2014. This evidence showed that, in CEECs, past experience with flood damage stimulates protective behaviour (see also Biernacki, Działek, Janas, & Padło, 2008; Knuth, Kehl, Hulse, & Schmidt, 2014); however, the time gap from the last flood event is important—the flood risk is not perceived as a permanent characteristic of a local environment (Raška 2013; Działek et al. 2013). Flood insurance is considered to be a major individual mitigation measure, and insurance demand is dependent on the perceived flood threat (Duží, Vikhrov, Kelman, Stojanov, & Jakubínský, 2015; Zaleskiewicz, Piskorz, & Borkowska, 2002). On the other hand, numerous studies revealed the strong reliance of the public upon the national government in terms of both prevention measures and provision of post-disaster financial support (e.g., Armas & Avram, 2012; Vari, Linnerooth-Bayer, & Ferencz, 2003). In their recent study from Czechia, Bera and Daněk (2018) have shown that different entities are expected to conduct specific FRM tasks. They also revealed that individual prevention and preparedness are perceived as voluntary tasks, while emergency and recovery actions are expected to be obligatory tasks undertaken by the local governments and state agencies. None of these studies, however, intended to seek for the relation among the expected governmental responsibilities and the willingness to undertake individual measures.

## 1.2 | Research aims

In this paper, we use the flood risk perception approach to investigate the balance and possible inverse

proportions between perceived governmental efforts and individual willingness to pursue flood mitigation measures in Czechia. We use the results of flood perception surveys among individuals in two flood-prone Czech municipalities to reveal the discrepancies between the expected responsibility-sharing and the actual willingness for individual flood risk reduction. Our major research question is whether the individually expressed expectations of the responsibilities of various actors are perceived as coherent with the actual FRM actions. Our hypothesis is that the higher the expectation of citizens regarding the state, the lesser is their willingness to undertake individual mitigation measures. Within this hypothesis in mind, we will explore (a) what are the current and considered individual FRM actions among the respondents, and (b) whether the individual willingness to undertake FRM actions and general expectations of responsibility sharing differ within the specific local flood threat and coping appraisal. In the following sections, we will first introduce the study areas and the methodology of the survey. Then, we will continue to outline the differences in flood threat appraisal in the study areas (Section 3.1) and public trust in the efficiency of current FRM measures (Section 3.2), both of which are assumed to determine the expectations of responsibility sharing in FRM (Section 3.3). Finally, we will discuss the factors that may cause the differences in expected and actual responsibility-sharing within multilevel FRM, with particular emphasis on the inverse proportion between governmental and individual action (Section 4).

## 2 | METHODS

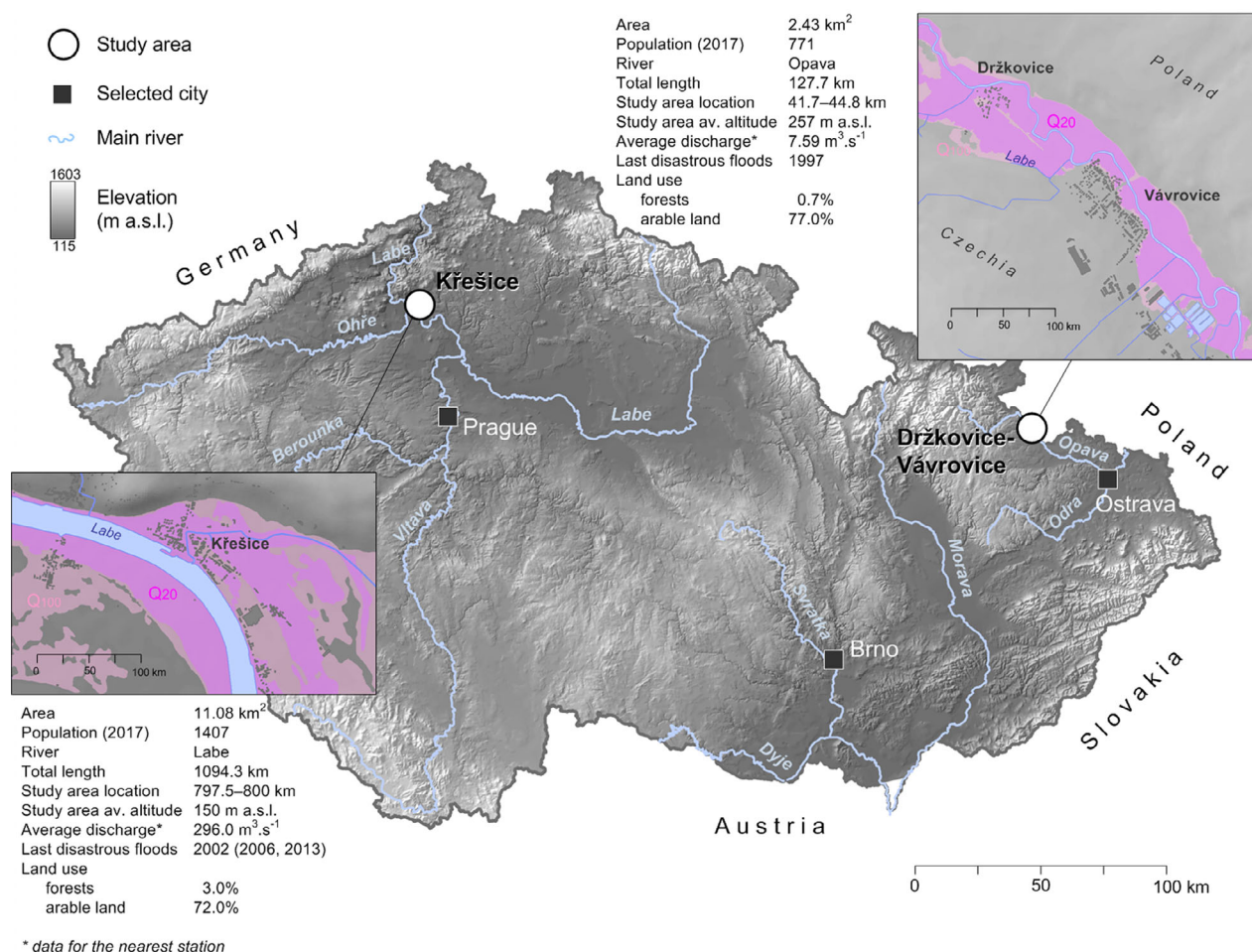
### 2.1 | Study areas

Two study areas were chosen to obtain the information necessary to explore the research questions. Three basic criteria were defined for the selection of the study areas. First, we focused on areas with significant flood threats and which experienced disastrous floods in the last two decades. Second, we focused on smaller municipalities in peri-urban or rural areas. Our assumption was that, in these areas, the relationship between individual action and FRM is closer than in urban centres (cf. Slavíková et al., 2019), which facilitate the risk perception approach of the study. In addition, it is assumed that their location outside of urban centres results in institutional distance from the national government, which may hinder the implementation of structural FRM measures (Consoer & Milman, 2018). Finally, the areas were chosen from different environmental (catchment size, flood frequency) and socioeconomic (administrative unit, demographic

structure) contexts to reveal the scale-dependent and local deviations within country-wide FRM efforts. Using the implicit selection procedure, the study areas of Křešice and Vávrovce-Držkovice were chosen for the research. The locations and basic characteristics of these study areas are provided in Figure 1. Located in North Czechia, Křešice represents a municipality on the river-bank of the lower Labe (Elbe) River, the Czech largest River in terms of average annual discharge and catchment size resulting in high catchment complexity. The historical records of floods date back as far as to the medieval period, but the highest known discharges are recorded for the 1890 and 2002 floods. After the disastrous 2002 Central-European flood, a flood retention wall has been constructed, but it is designed only for  $Q_{20}$  floods. The Catchment flood management plan from 2015 defines the area as susceptible to floods, but without specific local measures. The specific recommendations for FRM are listed in the municipal spatial plan from 2018: to maintain agricultural land to accelerate the

runoff from the area, to improve transport accessibility for emergency management, to build a dry polder for the nearby tributary of the Labe River, to use the mobile flood protection measures and to use ditches along the roads to convey the water.

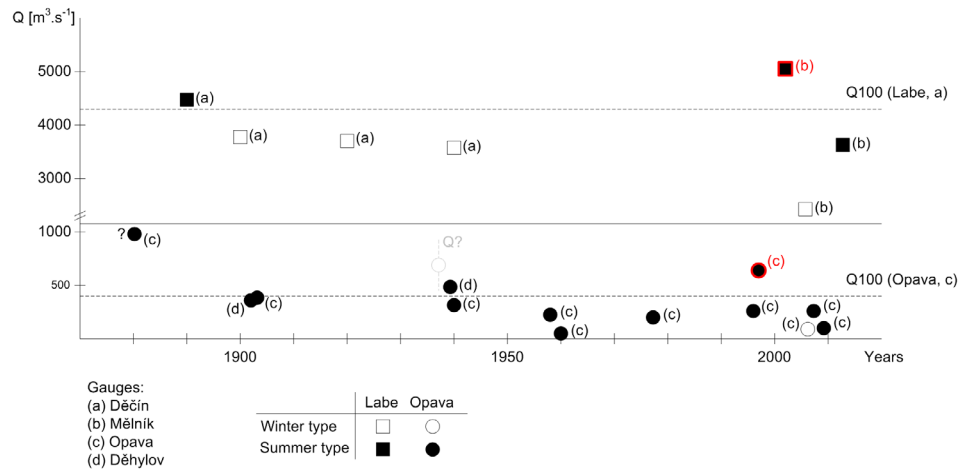
Vávrovce-Držkovice is a peri-urban part of the Opava town in Northeast Czechia, located in the middle part of the Opava River near the border with Poland. The Opava River is a small tributary of the Odra (Oder) River and has a significantly lower average annual discharge than the Labe, yet the area has experienced several disastrous floods in the past. In terms of FRM measures, the water dam for flood protection was designed after a disastrous flood in 1997, but was not constructed to date because the regional Water Catchment Authority did not reach an agreement with the public. The retrospective for the major floods in the study areas is provided in Figure 2, and indicates differences in flood frequencies, types, and culmination discharges. The Catchment flood management plan from 2014 includes the area among the flood-



**FIGURE 1** Location and basic characteristics of the study areas



**FIGURE 2** Major floods in the study areas since the end of the 19th Century. Note: some data on culmination discharge are provided for the nearest station, (a) Děčín station (downstream from Křešice), (b) Mělník station (upstream from Křešice), (c) Děhylov (downstream from Vávrovice-Držkovice). Symbols with red outline mark the major recent floods. Data compiled from multiple official sources and reports



prone river segments and suggests individual preventive measures related to the most threatening objects. The additional documentation for the areas of high flood risk recommends the construction of a flood protection wall on the right riverbank of the Opava in the Vávrovice, because the area is affected by floods even of five-years discharge ( $Q_5$ ).

## 2.2 | Data collection and analysis

A face-to-face PAPI (Paper Assisted Personal Interviewing) questionnaire survey was conducted in 2016–2017 and was based on quota sampling to increase the representativeness of the sample. Age and gender categories were chosen as quotas derived from population

**TABLE 1** Population structure (Census 2011) and sample structure (own research) for the study areas

	Křešice (%)		Vávrovice-Držkovice (%)	
	Census <sup>a</sup> (%)	Sample (%)	Census <sup>a</sup> (%)	Sample (%)
Gender				
Male	50.5	52.7	50.0	50.7
Female	49.5	47.3	50.0	49.3
Total	100.0	100.0	100.0	100.0
Age <sup>b</sup>				
15–29 years	21.4	17.1	22.9	23.3
30–64 years	59.2	65.8 <sup>c</sup>	59.5	58.7
65+ years	19.4	17.1	17.6	18.0
Total	100.0	100.0	100.00	100.0
Education				
Elementary and unknown	30.5	3.1	20.7	4.0
Secondary	63.1	77.9	67.9	79.0
Tertiary	6.4	19.0	11.4	17.0
Total	100.0	100.0	100.0	100.0
Economic activity				
Employee	37.8	58.9	51.9	62.0
Employer	6.5	13.5	1.9	4.0
Other	55.7	27.6	46.2	34.0
Total	100.0	100.0	100.0	100.0

<sup>a</sup>Data from the last national census in 2011 (SLDB, Czech Statistical Office).

<sup>b</sup>Numbers indicate share of each category on population over 15 years of age.

<sup>c</sup>Deviance from population structure in this category exceeds the criteria by 1.6 percentage points.

structure according to the last official census in 2011. A maximum of 5% points deviation between the sample and population structure for each quota was defined as a criterium *ex-ante* (Table 1). In the first round of the survey, community gatekeepers (e.g., administrative representatives, teachers, etc.) were contacted to obtain information on the best approach to contact respondents and collect data. The questionnaire consisted of identification questions (age, gender, education level and field, occupation, type of housing) and a further 14 questions in three thematic segments: (a) perception of flood threat (perceived susceptibility and severity); (b) perception of crisis operation processes; (c) perception of flood risk reduction, including evaluation of previous FRM measures, perception of FRM responsibility sharing, and willingness to conduct individual FRM measures (replies to some of these questions were also localised using mental maps). Since the questionnaire was conducted within the context of a research project devoted to the broader spectrum of flood risk issues, only some questions are used for the analysis in the present study. The questions were analysed using descriptive statistics. Cramer's V and Spearman correlation analyses were performed to reveal particular patterns within the data.

### 3 | RESULTS

#### 3.1 | Setting the scene: Flood threat appraisal

The inhabitants of both study areas have experienced disastrous floods in recent decades. The time gap since the last flood differs (Figure 2), however, as did the timing of and decision processes for FRM measures within the specific settings of the study areas. Therefore, our first step was to reveal the differences in perception of flood threat appraisal. To limit possible uncertainties within the responses to individual questions, the aggregation of four questions was used to assess the perception of threat: *How often are you influenced by floods?*; *When will a flood appear in your place of residence?*; *How do you assess the impacts of flooding in your region?*; *How often and in which ways are you influenced by floods?*. According to this procedure, the general perception of threat appraisal was classified into four levels (Figure 3):

1 *Low*—the area was perceived to be influenced by floods scarcely or not at all, floods are not expected to occur within the next 10 years, and their impacts were also assessed as low. Respondents in this group declare that they are not at all influenced by floods.

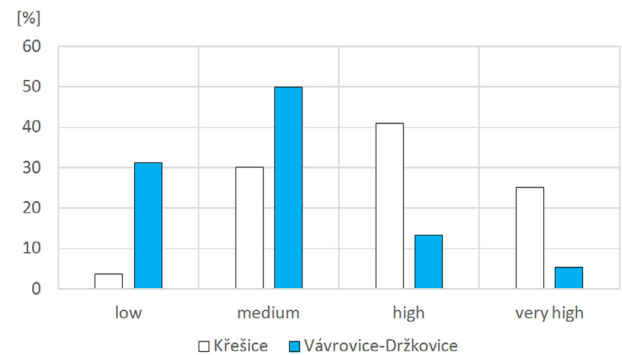


FIGURE 3 Perception of flood threat appraisal

- 2 *Medium*—the influence and frequency of floods were perceived as scarce, but the impacts or damage were observed as medium, and another flood was expected in fewer than 10 years.
- 3 *High*—floods are perceived as frequent phenomena, another was expected to occur in fewer than 5 years, and the damage caused by floods was assessed as above-average, while the general influence of floods on lives was evaluated as significant.
- 4 *Very high*—floods are perceived as a significant and frequent threat in the area, the impacts of floods were assessed as extreme, and the next flood is expected to occur in less than a year. Floods are seen as regular and significant phenomena.

Certain differences were identified between the two study areas. In Křešice, the perception of flood threat appraisal is significantly higher than that in Vávrovice-Držkovice. More than 40% of respondents assessed the threat as high, and more than 20% assessed it as very high. A significantly different assessment ( $p < .05$ ) was made by respondents from Vávrovice-Držkovice. More than 30% state that the flood threat in the region is low, and exactly 50% declared that they perceive threat as medium (Figure 3). It is also worth noting that there is no significant association between the observed impacts of floods and their frequency and extent. The aforementioned differences in the perception of flood threat appraisal are especially obvious when comparing the respondents' opinions on how much they feel they are affected by floods. While 64% of respondents in Křešice expressed being frequently and significantly affected by floods, such opinion was given by only 19% of respondents in Vávrovice-Držkovice. According to the data on flood frequency and the survey results, the two main factors that contribute to these differences include: (a) the time gap since the last flood and expectations about future flood frequency, (b) varying levels of exposure of the surveyed households to floods and the location of

critical infrastructure (potentially increasing indirect flood effects on households). In the following sections, these results are used to indicate the possible role that perceptions of spatiotemporal scales have in evaluations of FRM measures and the willingness for individual action.

### 3.2 | Evaluation of current FRM measures

Certain differences in perception were found in relation to the perception of existing flood risk reduction strategies and measures. Respondents in both Křešice and Vávrovice-Držkovice agreed that flood damage could not have been avoided (44 and 41%, respectively). However, of those who admitted that damage could have been avoided, more than 23% thought that eventual flood protection measures would be too expensive. According to these results, it can be stated that eventual strategies and measures for flood damage mitigation do not meet the expectations of local communities, either in terms of economic or practical efficiency. Such results also indicate a weaker perception of general coping ability among the local populations. To understand whether such a general perception is influenced by limited knowledge about the specific FRM measures within the study areas, the respondents were asked to list the currently completed measures in their municipality and to evaluate their perceived impact on flood risk reduction.

Differences were found in the perception of the effects of recently established flood risk reduction measures on future flood damage reduction. After the 2002 floods, various measures have been considered for Křešice. In total, 65% of the respondents noticed the existence of some measure – 84% of them specifically naming the mobile flood retention walls designed after 2002, while other measures, such as the new evacuation plan, were only scarcely noticed. On the other hand, only 23% of those who expressed knowledge of the existence of any flood risk reduction measure perceive these measures as potentially effective in reducing future flood damage. Low trust in the positive effect of these measures (particularly the flood retention wall) are expressed as results of flood frequency and flood magnitude exceeding the construction design of the retaining walls. In addition, the respondents referred to the combined effects of flooding from the Labe River and its small tributary, which flooded the areas beyond the retaining wall during the 2013 flood. To the contrary, the data from Vávrovice-Držkovice indicates a more variegated knowledge about the flood risk reduction measures, and a generally higher confidence in their efficiency. While only 33% of respondents noticed

any significant flood risk reduction measure, the majority of these respondents was able to list the specific measures, including new water reservoirs, channel adjustments and sediment removal, and the local public radio warning system. In total, 76% of respondents listing any flood risk reduction measure did express their trust in its efficiency during eventual future floods. Based on the results, it can be hypothesised that (a) there is a general acknowledgement of the inevitability of a certain level of flood risk, (b) new flood protection measures undertaken in both study areas are not perceived as fully sufficient, but (c) the perception of coping appraisal differs according to existing experience with these measures and perceived flood threat. Namely, in Vávrovice-Držkovice the expected positive effect of FRM measures (not assessed during any major flood event, yet) negatively correlates with flood threat appraisal ( $r = -.39$ ,  $p = .02$ ), which is in contrast to Křešice ( $r = .31$ ;  $p = .01$ ).

Another assessed component of FRM is the effectiveness of providing the public with information during flood events (question: *Are you satisfied with the information provided by the municipality during flood events?*). Regardless of the level of the flood threat, which is different between study areas, the information provided by the municipality during floods was perceived as satisfying. In total, 75% of all respondents declared satisfaction with the delivered information, while only 13% noticed certain problems in the information system, such as delivering useless information, delays in transferring information or lack of comprehensive information about the flood situation. Less than 13% of respondents were not interested in receiving any information about flood events. Compared to structural flood risk reduction measures, these results indicate higher perceived efficiency of and trust in the FRM measures related to crisis management (warning messages and crisis operation).

### 3.3 | Responsibility sharing and individual action

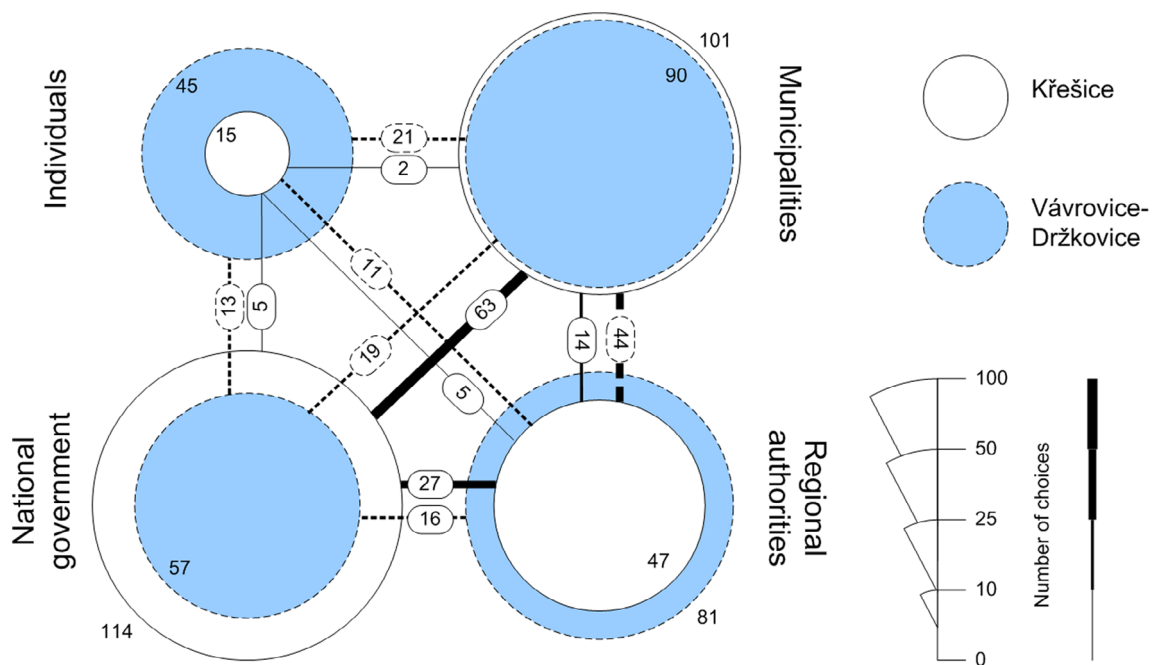
The above-presented results may be summarised in two factors that affect the expectation of responsibility-sharing and the particular roles of actors within multi-level flood risk governance. First, they indicate the different levels of flood threat appraisal in the study areas caused by the differing perception of spatiotemporal scales of flood threat and eventual flood losses. Second, the results indicate general patterns in the perception of coping appraisal that appear to be preconditioned by preferred FRM measures and underscored by their expected effects. Based on these results, we will further explore the expected responsibility-sharing for FRM in the study

areas and attitudes related to individual flood mitigation behaviour.

Our key question related to revealing expected responsibility-sharing among multiple actors aimed to identify “Who should first of all cooperate in reducing flood damages?” (in Czech semantically meaning who should be responsible for initiating the cooperation in FRM efforts). In response to this question, respondents may have indicated more than one choice from among individuals, the local government, the regional government, the national government, or other (with a possibility to name the specific entity). Regardless of the perceived flood threat appraisal, both groups agreed that the responsibility should be divided between at least two actors (80% of all answers). Thus, the respondents expressed the notion that effective flood risk reduction requires the involvement of multiple entities. However, both groups of respondents stated that the involvement of citizens should be the lowest (Figure 4). In Křešice, where the threat appraisal was higher, the authorities at the municipal and national level were said to be those that should be most involved (36 and 41%, respectively), while the direct public involvement was declared to be ~5%. The perception of responsibility sharing was quite different in Vávrovice-Držkovice, where the perceived flood threat is lower. In this area, high expectations were also placed on the municipality (32%), but the second most responsible entity should be the regional

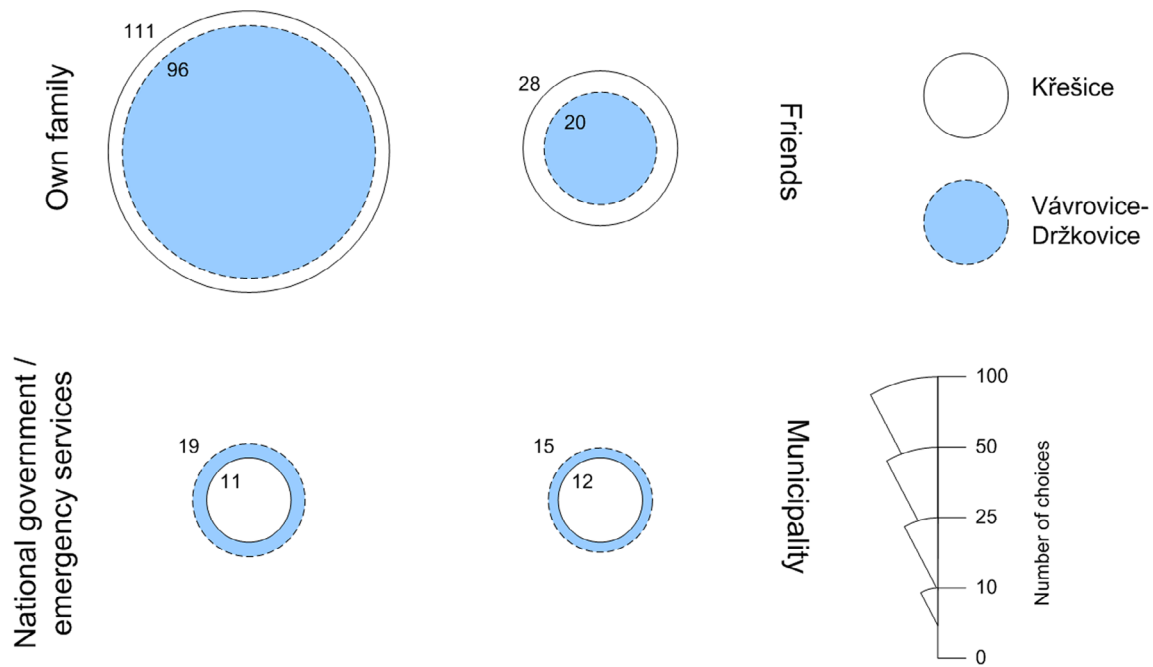
government (29%), which stood slightly above the level of expectation regarding the national government (21%) and individuals (16%). In relation to standard deviation and coefficient of variation for this answer, it can be stated that the dispersion of responsibilities in the two areas is significantly different ( $p < .05$ ; coefficient of variation is low at the level of 32% in Vávrovice-Držkovice, while it accounts for 54% in Křešice). This result suggests that, in Vávrovice-Držkovice, a more balanced engagement of the governmental and individual actors is perceived as suitable for effective management of flood risk.

After the expectation of individuals related to responsibility-sharing was described, the daily practice of FRM is outlined by actions actually undertaken by actors in FRM. Namely, respondents were asked to identify the source of help during flood events, along with an indication of reliance on each entity. The vast majority of respondents (62% of all answers) stated that they rely mostly on close family members, followed by other personal networks (Figure 5). There is a slight, yet statistically insignificant tendency to rely on governmental entities among those with stronger flood threat appraisal in each case study. These results are also supported by statements referring to individual help during floods and the recovery phase. In total, 85% of respondents expressed that they help others (71% of them by physical labour) in Křešice, and 75% (69% by physical labour) helped others in Vávrovice-Držkovice.



**FIGURE 4** The dispersion of responsibilities according to the respondents. Note: the circle size shows the number of choices given to specific entities in the study areas, while links indicate frequency, with which the particular pair of entities was chosen. (The choice for *other* entity is excluded)





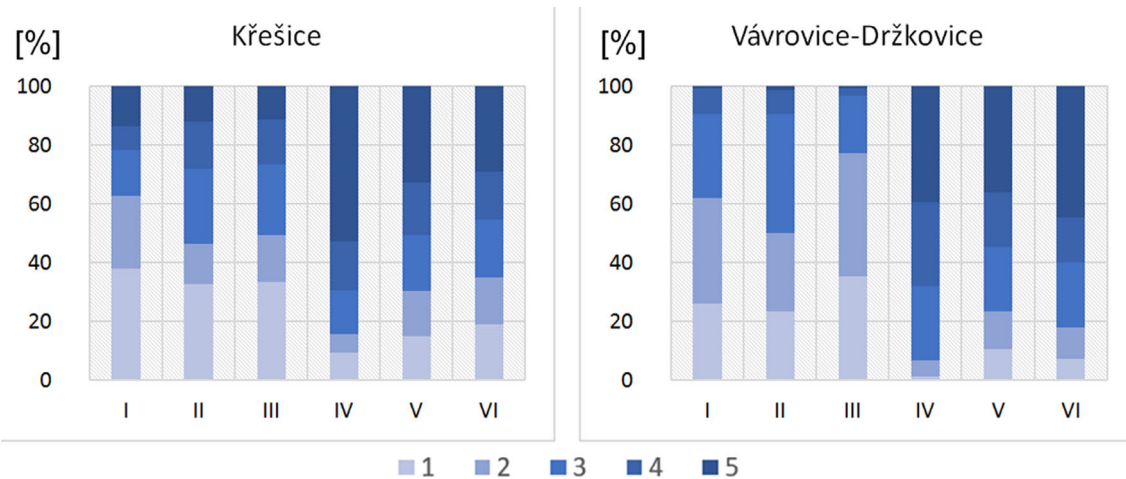
**FIGURE 5** The dispersion of actual reliance on help during flood events expressed by respondents. Note: the circle size shows the number of choices given to specific entities in the study areas

Our further questions aimed to reveal the particular actions undertaken by individuals and their willingness to participate in multilevel FRM efforts. Among the key ways to reduce flood losses on private properties regardless of the government's actions is market-based insurance, which is voluntary in Czechia and based on risk-reflective premiums. In Křešice, 25% of respondents stated that floods were the main reason they insured their property, and 42% declared that floods were not the main reason, but still represented an important factor for their decision to buy insurance. In Vávrovice-Držkovice, the willingness to insure private property was slightly different: 52% of respondents insured property from flood damage, but flooding was not the main reason for buying insurance (flooding was the main reason for only 3%).

As market-based insurance is concerned only with a certain aspect of responsibility-sharing (post-flood financial recovery), the survey further focused on perceptions of the engagement of individuals in other FRM domains. In particular, respondents were asked to assess their willingness to undertake specific participative actions, both before and during flood events, by expressing their attitude towards each statement: (1) *I would be willing to contribute financially to the flood reporting system in the municipality*; (2) *I am willing to financially contribute public funds to protect private property*; (3) *I am willing to financially contribute public funds to protect public property*; (4) *I am ready to help other people affected by the flood*; (5) *I would take part in a public discussion about*

*flood protection plans in the municipality*; and (6) *I would agree to devote part of my land to flood protection*. The attitudes were assessed on a five-point scale where “1” is a representation of the weakest approval and “6” the strongest approval (Figure 6).

Respondents in both groups declared a rather slight willingness to engage in particular long-term FRM efforts. The mean support for all statements was identical for both groups (average ranking = 2.9, average absolute difference = 0.08). In this context, individuals perceive themselves as passive actors in multilevel FRM. A more detailed view provides a rather variegated image with respect to differences among respondents and differences in approval of individual statements. First, the respondents who reported being actively involved in flood recovery (helping physically, financially or otherwise) tended to be more willing to undertake further individual efforts in both study areas (Křešice  $r = .46$ ,  $p = .05$ ; Vávrovice-Držkovice:  $r = .54$ ,  $p = .05$ ). Second, although not significant, certain differences in preference have been identified for particular statements. The strongest approval is claimed for efforts that are voluntary and which do not require financial contributions, that is, participation in flood protection plans or reservation of private land to alleviate peak discharges (average ranking = 3.6). However, the willingness to contribute public funds for the protection of both private and public land, or to establish a flood reporting (warning) system, was rather low in both areas (average ranking = 2.3).



**FIGURE 6** Willingness of respondents to undertake particular FRM actions. FRM, flood risk management

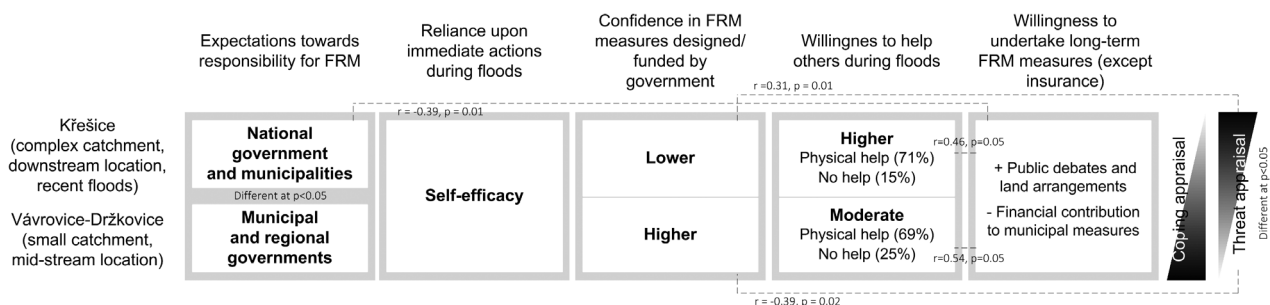
The final step of our analysis was to test whether there exists a statistically significant relationship between the expressed expectations of the responsibility of individual entities and the willingness to undertake specific FRM efforts. A negative correlation between reliance on governmental bodies and actions taken by citizens was found in Křešice ( $r = -.39$ ,  $p = .01$ ), but no such patterns were revealed in Vávrovice-Držkovice.

## 4 | DISCUSSION

The current discourse suggests that the effectiveness and efficiency of multilevel governance in FRM is dependent on the clearly defined and socially acceptable responsibilities of individual entities and of their cross-level interactions (e.g., Newig et al., 2014; Termeer et al., 2010). Defining these roles and interactions poses a key challenge for reconciling eventual conflicts and discrepancies emerging from institutional fragmentation (Gilissen et al., 2016) and the eventual inverse effects of governmental and individual efforts. Integrated FRM requires the engagement of large number of stakeholders,

including citizens, private owners, and public authorities among others (Di Baldassarre et al., 2019; Kreibich et al., 2011; Mees et al., 2016), where participation of all actors is formally required in accordance to EU Floods Directive. In this paper, we presented the risk perception surveys from Czechia in order to find further empirical evidence from Central Europe to inform the implementation of the EU Floods Directive using a multilevel approach.

First, we explored whether there exists a convergence between the expected responsibility-sharing and the actual efforts within the FRM. Our results (see summary outlined in Figure 7) suggest that, according to individuals in the flood-prone study sites, the governmental bodies at various levels are perceived as the entities most responsible for undertaking or initiating FRM efforts. This is in general agreement with previous results obtained by empirical studies and reviews for post-socialist Central European countries (e.g., Raška, 2015), where rather strong reliance upon governmental bodies is explained as a result of institutional path-dependence. The question remains, however, whether the expectations regarding higher-level governmental bodies lead to



**FIGURE 7** Summary of expected and practised FRM actions in the study areas. Note: only statistically significant relations are shown. FRM, flood risk management

negligence in acting at the individual level, that is, whether such expectations crowd out the individual action (Slavíková, 2018). The survey indicated that, during floods, most respondents rely on their abilities and personal networks. Despite certain differences in perceived flood threat appraisal, this result was confirmed for both study areas. In addition, within-case analyses showed only a slight variance in preference towards governmental help among respondents with different perceptions of flood susceptibility and severity. Such results indicate a generally higher perceived self-efficacy (Bandura, 1997) as a belief in the ability to carry out efficient behaviour when facing floods. This explanation is supported by expressed willingness to help (mostly physically) during floods and recovery, that is, in a short-term, but at the same time, it does not preclude high demand on governmental long-term actions. Proving the conceptual relation between perceived self-efficacy, the use of personal networks and the willingness to undertake short-term FRM measures requires further evidence, however (Bubeck et al., 2012; Grahn & Jaldell, 2019). A possible explanation for self-reliance is provided by expressed low confidence in currently completed flood risk reduction measures and disappointments about the previous governmental efforts. Such perceptions may result in low perceived coping appraisal regarding these measures and higher level of individual efforts; thus contradicting the crowding-out thesis (Slavíková, 2018). The statistical relation between the confidence in governmental measures and individual actions has not been confirmed, however. Such a negative result may be affected by a limited sample used for this particular analysis (only 65 and 33%, respectively, respondents listed any existing measure), and calls for further evidence.

Both higher perceived self-efficacy and low confidence in governmental FRM measures contradicts individual willingness to undertake the long-term FRM efforts, however. Except of individual/household insurance as the most frequent individual FRM strategy (see also similar studies by, e.g., Botzen et al., 2009; Duží et al., 2015), there is only a slight willingness to participate in public debates and land arrangements. The willingness to financially support the local FRM measures is generally low. In summary, the stronger approvals are claimed only for efforts that are voluntary and which do not require financial contributions. Regarding the eventual crowding-out effect (Slavíková, 2018), the willingness for the long-term individual participation on FRM are in a rather inverse proportion with both the expressed public expectations regarding the governmental actions and the actual governmental efforts (see further text).

These findings contribute the current discussion on establishing the multilevel flood risk governance schemes

as they identify a kind of ‘governance loop’: that is, the situation where the government increasingly attempts to initiate public participation top-down (cf. Mees et al., 2016), but there remain generally strong public expectations regarding governmental role in FRM. The perceived disappointments about sufficiency of governmental measures, however, finally results in individual self-mobilisation that accentuates individual self-reliance and personal networks.

Second, the results of the survey indicate differences in the study areas in some respects. In particular, while reliance on and willingness to engage in individual efforts are similar in both study areas, the expectations of responsibility-sharing among various entities show clear differences. As a result, a negative correlation between reliance on governmental bodies and willingness to engage in individual efforts (short- and long-term together) was found in Křešice but did not in Vávrovice-Držkovice. Regarding the long-term FRM efforts, the rather different expectations of governmental efforts in the study areas indicate the influence of scale (cf. Termeer et al., 2010) on the perception of flood severity (influencing threat appraisal) and perceived effect of FRM measures (influencing coping appraisal). First, the respondents from Křešice have a stronger flood threat appraisal, explained by a higher frequency of floods with extreme impacts in recent years. The relatively recent experience with disastrous floods in Křešice also resulted in public disappointments and low confidence in the previously completed FRM measures. In addition, it may be hypothesised that the location of Křešice in the inundation area of the lower Labe River catchment implies the respondents’ perceptions of the lower effect of the FRM efforts within the large and complex catchment. In Vávrovice-Držkovice, in turn, the last experience with disastrous floods already dates back 20 years, and there is a relatively higher confidence in the efficiency of recently completed (yet not verified) FRM measures within the rather small catchment. These findings confirm the results of other studies that indicate the role of previous experience in FRM efforts (e.g., Biernacki et al., 2008; Osberghaus, 2015; Richert et al., 2017). In addition, however, they also accentuate the influence of spatiotemporal scales when understanding the nature of flood risk perception attitudes. While the current studies have indicated possible inverse proportions between the self-efficacy and risk perception resulting from opposite effects of social capital (Babcicky & Seebauer, 2017), our results indicate this proportion may have a rather variegated nature depending on the respective scale. As a result, even the communities with strong risk perception may display high social capacity and self-efficacy if located in complex catchments and experiencing floods

recently. The implications of these findings are that the FRM efforts resulting from EU Floods Directive and percolating universally down to certain administrative levels (e.g., municipalities) must consider the socio-environmental scales of the particular areas when stimulating public participation and arguing for individual FRM measures.

## 5 | CONCLUSIONS

The paradigmatic shift towards multilevel flood risk governance exacerbated by international strategies calls for a better understanding of the expected balance of responsibilities taken by entities engaged in FRM. In this paper, we aimed to contribute to the current evidence regarding the balance between governmental efforts and individual actions from a Central-European post-socialist perspective, which is still rather lacking in academic debates. Despite certain limitations of the research based on local case studies must always be considered, our findings from two flood risk perception surveys point out several insights that contribute the current research of responsibility sharing within the multilevel flood risk governance. These are summarised in the following points:

- There is a general expectation that governmental bodies will initiate multilevel FRM, but the confidence in the positive effect of the completed FRM measures is rather low, which may finally support some individual mitigation measures. Individual actions are mostly restricted to physical help during floods and recovery and to investments in private insurance. In addition, individuals tend to rely upon their self-efficacy and personal networks during floods and immediate recovery. In this respect, disappointments about sufficiency of governmental actions stimulate responsibility sharing by individuals. The individual willingness to participate in further long-term FRM efforts is low, however. As a result, long-term individual participation on FRM is in a rather inverse proportion with the expressed public expectations regarding the governmental actions and actual governmental measures. This adds new and more variegated insights to the crowding-out thesis that until recently advocated the prevailing negative effects of governmental actions on the individual mitigation measures.
- The expressed expectations from individual actors taking part on FRM as well as confidence in FRM measures and individual mitigation measures are, however, locally diversified by perceived flood susceptibility and severity, recent flood experience and perceived scale of the FRM efforts and catchment

complexity. It is concluded that along with conventionally explored sociodemographic determinants the perception of scales and complexity represents an important factor affecting expected responsibility sharing in multilevel flood risk governance schemes.

## ACKNOWLEDGEMENTS

P. R. and L. S. thank the Operational Programme Research, Development and Education of the Czech Republic for financing the project Smart City—Smart Region—Smart Community (grant number: CZ.02.1.01/0.0/0.0/17\_048/0007435) that led to the present paper. W. W. thanks to LAND4FLOOD (CA16209) supported by COST (European Cooperation in Science and Technology), [www.cost.eu](http://www.cost.eu), for the research stay during which the paper has been drafted.

## DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

## ORCID

Pavel Raška  <https://orcid.org/0000-0003-4206-8962>

## REFERENCES

- Armas, I., & Avram, E. (2012). Cognitive and emotional aspects in evaluating the flood risk. *Procedia Social and Behavioral Sciences*, 33, 939–943.
- Babicky, P., & Seebauer, S. (2017). The two faces of social capital in private flood mitigation: Opposing effects on risk perception, self-efficacy and coping capacity. *Journal of Risk Research*, 20(8), 1017–1037.
- Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York: W. H. Freeman.
- Bera, M. K., & Daněk, P. (2018). The perception of risk in the flood-prone area: A case study from the Czech municipality. *Disaster Prevention and Management*, 27(1), 2–14.
- Biernacki, W., Działek, J., Janas, K., & Padlo, T. (2008). Community attitudes towards extreme phenomena relative to place of residence and previous experience. In S. Liszewski (Ed.), *The influence of extreme phenomena on the natural environment and human living conditions* (pp. 207–237). Łódź: Łódzkie Towarzystwo Naukowe.
- Botzen, W. J. W., Aerts, J. C. J. H., & van den Bergh, J. C. J. M. (2009). Analysis: Willingness of homeowners to mitigate climate risk through insurance. *Ecological Economics*, 68, 2265–2277.
- Bubeck, P., Botzen, W. J. W., & Aerts, J. C. J. H. (2012). A review of risk perceptions and other factors that influence flood mitigation behavior. *Risk Analysis*, 32(9), 1481–1495.
- Consoer, M., & Milman, A. (2018). Opportunities, constraints, and choices for flood mitigation in rural areas: Perspectives of municipalities in Massachusetts. *Journal of Flood Risk Management*, 11, 141–151.
- Council of European Communities (2007) The directive on the assessment and management of flood risks (2007/60/EC) *Official Journal* L288.



- Di Baldassarre, G., Sivapalan, M., Rusca, M., Cudennec, C., Garcia, M., Kreibich, H., ... Blöschl, G. (2019). Socio-hydrology: Scientific challenges in addressing a societal grand challenge. *Water Resources Research*, 55(8), 6327–6355.
- Duží, B., Vikhrov, D., Kelman, I., Stojanov, R., & Jakubínský, J. (2015). Household flood risk reduction in The Czech Republic. *Mitigation and Adaptation Strategies for Global Change*, 20(4), 499–504.
- Działek, J., Biernacki, W., & Bokwa, A. (2013). Challenges to social capacity building in flood-affected areas of southern Poland. *Natural Hazards and Earth System Sciences*, 13, 2555–2566.
- Figueiredo, E., Valente, S., Coelho, C., & Pinho, L. (2009). Coping with risk: Analysis on the importance of integrating social perceptions on flood risk into management mechanisms – The case of the municipality of Agueda, Portugal. *Journal of Risk Research*, 12(5), 581–602.
- Gilissen, H. K., Alexander, M., Beyers, J.-C., Chmielewski, P., Matczak, P., Schellenberger, T., & Suykens, C. (2016). Bridges over troubled waters: An interdisciplinary framework for evaluating the interconnectedness within fragmented flood risk management systems. *Journal of Water Law*, 25(1), 12–26.
- Grahn, T., & Jaldell, H. (2019). Households (un)willingness to perform private flood risk reduction – Results from a Swedish survey. *Safety Science*, 116, 127–136.
- Henstra, D., Thistlethwaite, J., Brown, C., & Scott, D. (2019). Flood risk management and shared responsibility: Exploring Canadian public attitudes and expectations. *Journal of Flood Risk Management*, 12(1), e12346.
- Kienzler, S., Pech, I., Kreibich, H., Müller, M., & Thieken, A. H. (2015). After the extreme flood in 2002: Changes in preparedness, response and recovery of flood-affected residents in Germany between 2005 and 2011. *Natural Hazards and Earth System Sciences*, 15, 505–526.
- Klůváňková-Oravská, T., ed. (2010). *From government to governance? New governance for water and biodiversity in an enlarged Europe*. Praha: Alfa Nakladatelství.
- Knuth, D., Kehl, D., Hulse, L., & Schmidt, S. (2014). Risk perception, experience, and objective risk: A crossnational study with European emergency survivors. *Risk Analysis*, 34(7), 1286–1298.
- Kreibich, H., Seifert, I., Thieken, A. H., Lindquist, E., Wagner, K., & Merz, B. (2011). Recent changes in flood preparedness of private households and businesses in Germany. *Regional Environmental Change*, 11, 59–71.
- Lawrence, J., Quade, D., & Becker, J. (2014). Integrating the effects of flood experience on risk perception with responses to changing climate risk. *Natural Hazards*, 74(3), 1773–1794.
- Lo, A. Y. (2013). The role of social norms in climate adaptation: Mediating risk perception and flood insurance purchase. *Global Environmental Change*, 23, 1249–1257.
- Marks, G., & Hooghe, L. (2004). Contrasting visions of multi-level governance. In I. Bache & M. Flinders (Eds.), *Multi-level governance* (pp. 15–30). Oxford: Oxford University Press.
- Mees, H., Crabbé, A., Alexander, M., Kaufmann, M., Bruzzone, S., Lévy, L., & Lewandowski, J. (2016). Coproducing flood risk management through citizen involvement: Insights from cross-country comparison in Europe. *Ecology and Society*, 21(3), 7.
- Newig, J., Challies, E., Jager, N., & Kochskämper, E. (2014). What role for public participation in implementing the EU floods directive? A comparison with the water framework directive, early evidence from Germany and a research agenda. *Environmental Policy and Governance*, 24(4), 275–288.
- Osberghaus, D. (2015). Analysis: The determinants of private flood mitigation measures in Germany — Evidence from a nationwide survey. *Ecological Economics*, 110, 36–50.
- Penning-Rowsell, E. C., Priest, S., & Johnson, C. (2014). Evolution of UK flood insurance: Incremental change over six decades. *International Journal of Water Resources Development*, 30(4), 694–713.
- Pettersson, M., van Rijswijk, M., Suykens, C., Alexander, M., Ek, K., & Priest, S. (2017). Assessing the legitimacy of flood risk governance arrangements in Europe: Insights from intra-country evaluations. *Water International*, 42(8), 929–944.
- Priest, S. J., Suykens, C., van Rijswijk, H. F. M. W., Schellenberger, T., Goytia, S. B., Kundzewicz, Z. W., ... Homewood, S. (2016). The European Union approach to flood risk management and improving societal resilience: Lessons from the implementation of the floods directive in six European countries. *Ecology and Society*, 21(4), 50.
- Raška, P. (2013). Political regulations and social perception of natural risks: “risk society” the Czech experience and the European context. *Acta Universitatis Carolinae Geographica*, 48, 61–74.
- Raška, P. (2015). Flood risk perception in central-eastern European members states of the EU: A review. *Natural Hazards*, 79(3), 2163–2179.
- Richert, C., Erdlenbruch, K., & Figuières, C. (2017). The determinants of households’ flood mitigation decisions in France - on the possibility of feedback effects from past investments. *Ecological Economics*, 131, 342–352.
- Rollason, E., Bracken, L. J., Hardy, R. J., & Large, A. R. G. (2018). Evaluating the success of public participation in integrated catchment management. *Journal of Environmental Management*, 228, 267–278.
- Schanze, J. (2013). The long way towards tolerable flood risks – Initial lessons learnt from the recent central European floods. *Journal of Flood Risk Management*, 6, 167–168.
- Seifert, I., Botzen, W. J. W., Kreibich, H., & Aerts, J. C. J. H. (2013). Influence of flood risk characteristics on flood insurance demand: A comparison between Germany and The Netherlands. *Natural Hazards and Earth System Sciences*, 13, 1691–1705.
- Shao, W., Xian, S., Lin, N., Kunreuther, H., Jackson, N., & Goidel, K. (2017). Understanding the effects of past flood events and perceived and estimated flood risks on individuals’ voluntary flood insurance purchase behavior. *Water Research*, 108, 391–400.
- Slavíková, L. (2018). Effects of government flood expenditures: The problem of crowding-out. *Journal of Flood Risk Management*, 11, 95–104.
- Slavíková, L., Raška, P., & Kopáček, M. (2019). Mayors and “their” land: Revealing approaches to flood risk management in small municipalities. *Journal of Flood Risk Management*, 12, e12474.
- Termeer, C. J. A. M., Dewulf, A., & van Lieshout, M. (2010). Disentangling scale approaches in governance research: Comparing monocentric, multilevel, and adaptive governance. *Ecology and Society*, 15(4), 29.

- Terpstra, T., & Gutteling, J. M. (2008). Households' perceived responsibilities in flood risk management in The Netherlands. *International Journal of Water Resources Development*, 24(4), 555–565.
- Thaler, T., & Priest, S. (2014). Partnership funding in flood risk management: New localism debate and policy in England. *Area*, 46(4), 418–425.
- Thomalla, F., Lebel, L., Boyland, M., Marks, D., Kimkong, H., Tan, S. B., & Nugroho, A. (2018). Long-term recovery narratives following major disasters in Southeast Asia. *Regional Environmental Change*, 18(4), 1211–1222.
- Tunstall, S. M., Penning-Rowsell, E. C., Tapsell, S. M., & Eden, S. E. (2000). River restoration: Public attitudes and expectations. *Water Environment Journal*, 14(5), 363–370.
- Van Herk, S. (2014). *Delivering integrated flood risk management: Governance for collaboration, learning and adaptation*. Delft: CRC Press.
- Vari, A., Linnerooth-Bayer, J., & Ferencz, Z. (2003). Stakeholder views on flood risk management in Hungary's upper Tisza Basin. *Risk Analysis*, 23(3), 585–600.
- Vávra, J., Lapka, M., Cudlínová, E., & Dvořáková-Líšková, Z. (2017). Local perception of floods in The Czech Republic and recent changes in state flood management strategies. *Journal of Flood Risk Management*, 10(2), 238–252.
- Wehn, U., Rusca, M., Evers, J., & Lanfranchi, V. (2015). Participation in flood risk management and the potential of citizen observatories: A governance analysis. *Environmental Science & Policy*, 48, 225–236.
- Zaleskiewicz, T., Piskorz, Z., & Borkowska, A. (2002). Fear or money? Decisions on insuring oneself against flooding. *Risk Decision Policy*, 7, 221–233.

**How to cite this article:** Raška P, Warachowska W, Slavíková L, Aubrechtová T. Expectations, disappointments, and individual responses: Imbalances in multilevel flood risk governance revealed by public survey. *J Flood Risk Management*. 2020;13:e12615. <https://doi.org/10.1111/jfr3.12615>